with the tenth which has the anterior end convex with a rather abrupt central protuberance, and the posterior end subtruncate. Forceps shorter than the last or tenth segment, which is nearly as large as the eighth and ninth together, the ninth being about one half the size of the eighth. Forceps and last segment of the abdomen light brown, the rest of the insect whitish. The whole insect covered sparsely with hair-like bristles, these densest on the forceps. Abdominal appendages present, but minute.

Right arm of forceps with a large, broad based, sharply pointed and slightly backward inclining tooth, placed on the lower inner margin and distant from the base about one fourth the length of the arm. From this tooth to the base the arm is slightly concave, but about equal in thickness throughout; distally from the tooth the margin is very abruptly deflexed inwardly (sometimes almost at a right angle), for about one third the width of the arm; at the end of this smooth sinus is a denticule, generally broad and blunt, and some distance from this another similar one and between these two are often traces of two very blunt tubercles; then the margin is again deflexed, somewhat sharply and obliquely, this interrupted by two equal, saw-tooth-like denticules, always distinct and about equidistant from each other and the second denticule. No superior row of teeth. The left arm is very similar to the right and presents no constant difference either in size, strength or dentation.

Length without antennæ 3.85 mm.; length of antennæ .73 mm.; length of abdomen 2.55 mm.; length of last abdominal segment and forceps .43 mm.; length of forceps .17 mm.

Habitat: Southeastern Nebraska.

Four specimens of this little *Japyx* are in the collection of the University of Nebraska taken as follows: Malcolm, Nebr., May 4, 1901, one specimen; Crab Orchard, Nebr., May 7, 1901, one specimen; Adams, Nebr., May 11, 1901, two specimens. In all cases they were taken from among the roots of wheat growing in damp soil, and are probably quite common when carefully looked for. It is very different from any described species and may easily be distinguished by the combination of very small size, few joints in the antennæ, the head longer than broad, and the shape of the last three abdominal segments, as well as by the similarity of the two arms and the peculiar dentation of the forceps.

COLOR-PREFERENCE IN INSECTS.

By A. S. Packard.

In my "Text Book of Entomology" I have briefly stated from what sources I had access to, the little that was known up to 1898 as to the color-preferences of insects. It appears that few observations

had been made, the most careful being those of Lubbock who showed that the honey bee prefers blue, and ants violet. The following observations are published with the view of calling attention to this interesting matter, which in the case of flies and mosquitoes is a subject of no little importance.

Preference of Locusts (Acrydiidæ) for White.—My attention was first called to the preference of locusts for white by a letter to St. Nicholas in 1900 from Boothbay Harbor, Maine, written by Dorothy C. Baldwin to the following effect: "I would like to inquire why grasshoppers are attracted more by white than any other color? I have noticed that when I wear a white dress I find several grasshoppers on it, but when I wear any other colored dress they do not jump upon me at all." Upon inquiring as to others' experience, my daughter tells me that she always observed that white or light-colored clothes attracted grasshoppers, and when walking scarcely more than a hundred feet she has noticed five or six grasshoppers on her white dress, but none when the dress was dark in color. Another lady has also noticed that a white dress will attract "grasshoppers," or more properly, locusts.

Color-preference in Moths. — The late S. Lowell Elliot once told me of a case observed by him where white moths (*Spilosoma*, *Hyphantria* and *Acronycta oblinita*) would alight upon the white trimmings of a red and white barn, while on the darker, red portions, sat Catocalæ, and other dark or reddish moths. They were thus protected from observation.

An English writer states that *Bryophila perla* will frequently alight upon stone walls or those composed of grayish colored bricks, but in the case of a red brick wall, it will only alight upon the mortar between them, thus trying to harmonize its color with its surroundings.

M. Rocquigny-Adanson while walking with his insect-net saw *Adela degeerella* alight on the green gauze. In walking a distance of two hundred meters it did this twice (Bulletin Soc. Ent. France, 1903, No. 12, p. 207). His note was called out by that of M. Poujade, but he cited it as an instance of familiarity rather than of color-preference.

Color-preference in Butterflies. — I once observed at Amherst, Mass., that white butterflies (*Pieris*) would alight upon the flowers of a white aster, while *Colias philodice* would by preference alight upon the yellow flowers of the golden rod, but these observations need repetition before they can be accepted as a normal or regular occurrence.

It has also been stated by Lubbock or some other English entomologist that butterflies will descend from a position high in the air and fly down to bits of white paper, apparently mistaking them for white flowers.

On April 28 I saw in my yard a *Pieris rapæ* flying across a bed of violets, many in flower, and then after crossing the bed without pausing in its flight it rather suddenly turned down and alighted on a single white flower of the bloodroot, remaining at rest on it for one or two minutes. It was evidently attached by the white color, passing by the violets to visit the bloodroot. April 30 I saw two *Pieris* fly towards bits of white paper which I had thrown down; they did not alight upon them, but evidently were attracted to them, as they would turn toward them in their flight; but after this they took no further notice of the papers.

M. Poujade (Bulletin Soc. Ent. France, No. 9, 1903) mentions seeing *Thecla rubi* flying without fear around a green net and rest upon it if held still, but this familiarity ceased when the green was replaced by blue gauze. We should cite this as a case of color-preference.

Mr. Beverly Letcher writes me from San Francisco, June 5, 1902, regarding a case observed by him, which will illustrate both the range of butterfly vision and the preference for colors of the same hue as themselves, as a means of unconscious protection.

"I have for some years intended to communicate to you an observation on insect vision. I collect with a green cheese-cloth net which by July has faded to a yellow, closely approximating that of the female *Meganostoma eurydice*. I, as well as G. T. O. Mueller, with whom I sometimes collect, had noticed that the males flew directly into my net, but the particular instance to which I desire to call your attention is that of a male flying rapidly by in the open bushes at least 25 feet from the road on which I was collecting, and which suddenly turned at right angles to its course, flying directly at me and into the net."

Color Preference of Diptera. — Gross has observed that house flies would frequent a bluish-green circle on the ceiling of his chamber; but if it were covered by white paper, the flies would leave the spot, though they would return as soon as the paper circle was removed (Kolbe).

We have observed that house flies prefer green paper to the yellowish wall of a kitchen, but were not attracted to sheets of a Prussian blue paper, attached to the same wall and ceiling.

At Sugar Hill, N. H., while sitting on the hotel piazza, September 14, 1901, I noticed that the numerous house flies present alighted by dozens on my daughter's dress, which was of homespun dyed red and black, though the prevailing color was a madder or dark Indian red. Nearly fifty flies would come and alight within one or two minutes. On drawing a steamer rug, which was of a light faun color, over the dress, very few flies alighted on it, only one or two dozen. Also many alighted on my dark blue striped flannel trousers. On another occasion from fifteen to twenty flies alighted on a brown woolen dress, but none on a light gray waist. On still another occasion I noticed house flies gathering on a lady's black dress, while but one or two settled on the white towel next to it. A number rested on a dark lavender-colored shawl she was knitting, showing that they decidedly preferred lavender color to white.

I am told by a lady that the ribbon on her hat which was butter-yellow, and also of another shade of yellow, became so badly speckled that it had to be taken off, while white ribbon was not spotted. Her pale bright green dress, as she was sitting on the piazza, was literally covered with flies; indeed she took the flies away from all the other people sitting near by. The flies did not rest on a lavender-colored dress.

Mr. J. F. Collins, of Brown University, tells me that he noticed that a lady wearing a black silk gown was attended by "swarms of house flies." He also states that a number of black flies (*Simulium*) and mosquitoes alighted on his own person dressed in a black suit, while they did not alight on a man standing by who was wearing a white sweater.

In his notes on flower-haunting Diptera, read before the Entomological Society of London, Mr. Scott-Elliot shows that some of the higher types of flies appeared to prefer red and blue flowers.

Color-preference in the Mosquito. — In continuation of their researches on the structure and biology of *Anopheles maculipennis*, the commonest British mosquito and one known to convey malaria, Dr. Nuttall and Mr. A. E. Shipley observed some interesting facts on the preference this species exhibits for different colors and for different shades of color. The experiments were conducted as follows: In a spacious photographic studio a large muslin tent was set up with one end against the glass window through which the sunlight poured. At the bottom of the tent were some large pans for the *Anopheles* to breed in, and these were from time to time renewed. The mosquitoes were fed on bananas, which, it may be noted, must be kept fairly fresh, otherwise dates or figs are preferable. On one side of the tent seventeen boxes

without lids were piled one upon the other, the order being changed each day so as to eliminate any preference due to position or exposure to light. Each box was lined with a cloth having a slightly rough surface — not a shiny or smooth one — to which a mosquito could easily cling. The experiment consisted in counting the number of mosquitoes found in each box on seventeen different days. The results obtained are striking. During the seventeen days on which the count was made, 108 mosquitoes were found in the navy-blue box, 90 in the dark-red box, 81 in a reddish-brown box, 59 in the scarlet box, and 49 in the black box. There was at this point a sharp drop to 31 in a slate-gray box and 24 in an olive-green box. Violet, leaf-green, and full-blue boxes had respectively 18, 17 and 14. Pearl-gray had 9, pale green 4, light-blue 2, ochre and white 2 each, orange 1, and pale yellow about the color of khaki none at all.

It is thus evident that color has a marked power of attracting this species of mosquito, and that the color which is by far the most attractive is navy-blue. In both services and equally amongst civilians this is a very common, perhaps the commonest, color for male attire. The experiments just quoted show that it is at least equally popular with malaria-carrying mosquitoes. Light colors were avoided, especially those with a tinge of yellow. Khaki-colored garments would seem to have other advantages besides that of invisibility on a light soil.

The results of these observations, conducted on one species and in the midst of an English university town, must not too rashly be thought to hold good of other species living in the open; but there is a certain amount of evidence that points in the same way. It has been noticed in Indian hospitals that *Anopheles* hides on black coats and avoids white ones, so that the men who catch them take care to hang up a dark coat or two in the wards when they wish to collect the insects. The Frenchman Joly noticed in Madagascar that the mosquitoes were attracted by a black soil more than by a red or light one, and that persons wearing black shoes and socks were more often bitten than those who wore white or light coverings for their feet. Whilst a black dog was severely bitten, its companion, who was yellow, almost entirely escaped; thus the "yaller dog" of Western fiction has some advantages in this world.

Other observations not only point to a modification of dress in malarious districts, but they indicate that much may be done to render dwelling-houses and temporary shelters less habitable to the insects. Mr. J. Cropper has put on record how attractive the dark blue lining of the tent he used in Palestine was to *Anopheles* and to other Culicidæ, and Austen has noted that if the walls of a room be whitewashed with a dark dado the insects are invariably found on the dado and not on the light surface. This points to doing away with dadoes and using only whitewash.

The gist of these experiments, which seem to have a very practical bearing on life in malarious districts, was published in the *British Medical Journal* last September. They seem to have attracted little attention in this country; but the practical minds at the head of the United States army, without waiting for the fuller report, which appears in the current number of the *Journal of Hygiene*, have already decided to take action on the lines that the experiments indicate. We learn from the Surgeon-General's Office in Washington that the regulation army shirt of navy blue is to be withdrawn from all malarious districts, and a light one issued in its stead. (*English Mechanic*, January 24, 1902.)

From these few observations it appears that dark moths and butterflies prefer blue, red, black or green-colored objects on which to rest; that white butterflies are most generally attracted by white flowers; yellow butterflies by yellow flowers, while locusts decidedly prefer to rest on a white surface.

In the case of house-flies, and perhaps *Simulia* and Culicidæ, I have thought that as flies evidently love heat, being thermotropic, that as dark cloths absorb and retain the heat of the sun's rays better than white or pale materials, they "feel better," *i. e.*, they respond to the stimulus of the warmth of a dark surface, respire more rapidly and are more active; the cause being a physical one.

It is also evident that all these insects have good eyesight, distinguishing at a considerable distance the different colors of small objects, or of more extended surfaces.

SOME PHILIPPINE MOSQUITOES.

By C. S. LUDLOW.

The study of the mosquitoes in the Philippine Islands is carried on by the authority of the Surgeon-General, U. S. A., and with the cooperation of the Medical Department to ascertain at what places and times those proven or likely to be proven disease carriers are prevalent. The work has been in progress now for about three years, the collections having come in from all parts of the Islands, from Appari in Luzon to Jolo in the Sulu Archipelago, and the records show that besides the information gained for the medical phase of the study there has also been gathered some of value only from the entomological standpoint.

Among the mosquitoes listed below are some recently described by Theobald (British Museum) as found in adjacent countries, a couple of *Anopheles* previously published in the Journal of the New York Entomological Society, and some new species, one of which Theobald publishes with my permission, from my MS. in the new volume of his Monograph.

Mr. Theobald has lately created from the *Anopheles* the new genus *Myzomyia*, but as I do not know the distinctive characteristics on